Dynamics of Colostral IgG, Absorption in Beef Calves After Bottle Feeding, Stomach Tubing and Dam Suckling

L. Hungerford, R. Dewell, G. Dewell, G. Rupp, W. Laegreid and **K. Shuck**

Abstract

Many factors can affect passive transfer of immunoglobulins, including age of calf, total mass of immunoglobulins ingested, method of ingestion, breed, environmental temperature, calf vigor and cow mothering ability. Most field studies have used 12-48 hour IgG or total protein values to evaluate immune status (e.g less than 800=inadequate, 800-1600=marginal, greater than 1600=good) and have found improved health among calves with increasing serum levels (Wittum and Perino, 1995). A few studies have found 12-24 hour immunoglobulin values to be less predictive (Barber, 1978; Rea et al., 1996). The time between birth and achievement of adequate immunoglobulin levels may affect the disease incidence, especially due to enteric organisms, even if calves eventually receive colostrum. Experimentally, calves inoculated with E. coli before receiving colostrum were found to be as susceptible to disease as colostrum-deprived calves, regardless of the amount of colostrum subsequently provided (Logan et al., 1977). Early ingestion of colostrum should give calves a better chance to resist pathogenic microbes in their environment. There is wide variation in published curves for IgG absorption over time and many studies have used dairy calves. Our objectives were to determine how quickly IgG and total protein values would rise in unstressed, beef calves in a production setting and to compare the dynamics of absorption following colostral administration via stomach tube, bottle feeder or natural suckling.

Forty calves, from mixed breed beef cows in body condition 6+ with unassisted calving during the fall of 1 998, were used. Calves were weighed and randomly assigned, within each sequential group of four, to the immediate stomach tube (IST), later stomach tube (LST), bottle feeder (BF), or dam suckling (DS) groups. A colostral sample was collected from each dam. Calves in the IST, LST and BF groups received 40 ml/kg colostrum or the entire first milking from their own dams: within 30 minutes after birth for the IST and BF groups and at 4 hours after birth for the LST group. Calves were then muzzled or separated from the dam by a pipe gate to prevent nursing but allow close contact for 6 hours post feeding. Suckling times were recorded for calves in the DS group through 6 hours. Blood samples were collected at times 0, +0.5 hr, +1 hr, +1.5 hr, +2 hr, +3 hr, +4 hr, +5 hr, +6 hr, +7 hr, +8 hr, +12 hr, +24 hr post-colostrum. Packed cell volumes (PCV) and plasma total protein (TP) levels were determined. Single radial immunodiffusion was used to quantitate IgG, levels in serum and colostrum (VMRD, Inc, Pullman, WA.). Absorption curves were compared using repeated measures ANOVA (PROC MIXED, SAS Institute, Inc.; Littell et al., 1996). lndividual 4 hour TP levels were compared to the average of all TP measurements made at birth and ROC analysis used to determine the size of the difference which best predicted colostral intake. P values of $\leq$ 0.05 were considered significant.

The IgG and TP absorption curves differed significantly between treatment groups (see figure for IgG). However, ranges of values were almost as wide within groups as between groups. Although the DS group had the highest IgG levels, it did not differ significantly from the IST or LST groups. Therefore, tube feeding provides an excellent alternative if suckling is delayed. Since BF led to significantly lower absorption than the stomach tube groups combined, there is no justifiable clinical advantage to this method.
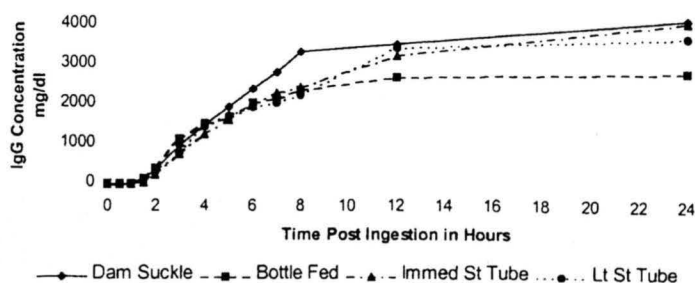
Figure 1. Change in immunoglobulin G1 concentration following colostrum ingestion—mean values for groups.

Although there were differences in the IgG and TP absorption curves, calf IgG levels reached 800 mg/dl in an average of 3-1/2 to 4 hours post-colostrum, regardless of group. Since calves which had not received colostrum had less than a 0.5 gm/dl increase in TP at 4 hours over the herd pre-colostral average (Sensitivity=87%, Specificity=89%), this provides a quick and easy means of identifying calves requiring supplementation. Delaying administration of colostrum until 4 hours of age did not affect the absorption rate, but did, of course, increase the total time period until the calf had passive IgG protection. This extended period of susceptibility could not be detected by IgG differences at 12 or 24 hours of age. This may explain the variation in neonatal morbidity among calves with adequate 24 hour IgG levels (Rea et al., 1996). Delays in acquisition of colostrum may critically jeopardize calf health.

References

Barber, D. 1978. Serum immunoglobulin status of purchased calves: an unreliable guide to viability and performance. Vet Rec 102:418-420.

Littel, R., Milliken, G., Stroup, W. and Wolfinger, R. 1996. SAS® System for Mixed Models. Cary, NC: SAS Institute Inc., pp 87-134, 491-502.

Logan, E.F., Pearson, G.R. and McNulty, M.S. 1977. Studies on the immunity of the calf to colibacillosis. VII:The experimental reproduction of enteric colibacillosis in colostrum-fed calves. Vet Rec 101:443-446.

Rea, D.E., Tyler, J.W., Hancock, D.D., Besser, T.E., Wilson, L., Krytenberg, D.S. and Saunders, S.G. 1996. Prediction of calf mortality by use of tests for passive transfer of colostral immunoglobulin. J.A.V.M.A. 208:2047-2049.

Wittum, T.E. and Perino, L.J. 1995. Passive immune status at postpartum hour 24 and long-term health and performance of calves. A.J.V.R. 56.1 149-1 154.